Using Tapeless Video Cameras in Science Classes

Introduction

Many schools and individual teachers now own digital cameras. This article covers the use of the "video clip" feature found on many of these devices. Note that some cameras are now marketed as "tapeless camcorders", designed specifically for video work. These cameras, such as the *Mustek DV 5000* and *5300SE* (Figures 1 & 2) and *Sanyo Xacti* (Figure 3) ranges may not offer many more video features than conventional digital cameras but their design makes them easier to use for that purpose. Additionally, they tend to be able to compress video files in such a way that more footage can be stored in their memory. The cameras described here can play back videos either via the small LCD screen or directly through the computer or TV, immediately and without the addition of any extra equipment save for a connecting cable. Alternatively, the clips can remain on the camera or can be transferred to a computer with the supplied software installed, for editing and playback later.

Uses

Bringing real world into the classroom

Many teachers now supplement their lessons with still photographs taken on digital cameras or downloaded from the Internet. The increased use of whiteboards and digital video projectors complement the use of these perfectly.

Figure 4 - Knockhill race circuit - a good source of dynamic footage

Digital video adds another dimension. For example, one teacher visited a wind farm and took video footage, panning around to give the children a better idea of the scale of the site and the relative size of the turbines. This opened up discussion on the impact of alternative energy solutions on the Scottish environment. A teacher visiting Knockhill race circuit recorded a yellow Ferrari driving round the track (See the online version on the SSERC website [1]). He found out the length of the track from information posters at the venue. On returning to work, he replayed the video to his class during the S4 Transport section of Physics

Figure 1 - Mustek DV5000 tapeless camcorder

Standard Grade, discussing with them how they could find the average speed of the car.

Extensive data on all the F1 circuits and statistics on the drives completed thus far can be found on the web [2].

Sharing learning intentions or summarising lessons

Video editing software, which is often bundled with the camera, makes it fairly easy to string together a number of clips into a short film. All have the ability to add titles and sound tracks. One teacher used this feature to summarise the key learning points of a 5-14 lesson on forces, interspersing text with film of the children working on a practical activity.

Reviewing practical work

When practical work is used to challenge the children and open up discussion it can be useful to have a record of the work to review with them. This has been used, for example, to record the results of a class's investigations into the attraction and repulsion seen when various types of plastic rods are charged by rubbing then brought together. The film clips were projected on to a screen and discussed.

Presenting investigative work

Many teachers are aware that individual pupils have their own preferred learning styles. Similarly, some pupils may be much more motivated if they are allowed to present their work to camera rather than solely on paper. Note that not all digital cameras with a video facility can record sound, though the camcorders mentioned here can do so. The Mustek can record sound files as separate entities so can be used as a digital audio recorder also.

Motion analysis - see future Bulletins for more on this area where video clips and other software are used.

Figure 2 - Mustek DV5300SE tapeless camcorder - available for around £60 with 512 Mb of memory.

Figure 3 - Sanyo Xacti tapeless camcorder. Costs around £130.

Technical issues

Most digital cameras store video clips as individual files memory or on a memory card. When the camera is connected to a computer, it usually appears as an extra disc drive. The video files can be moved and copied in the usual way or played directly from the camera.

Older computers running *Win98* or lower may require a small file (driver) to be installed to allow camera and the computer to communicate. This is often supplied on a CD with the camera.

There are a number of different types of video file formats. Most computers will play most types. Occasionally, when you try to play a file, the computer will report that it does not have the correct *codec*, the file that decodes a video clip. Some computers download these automatically from the internet. In other cases, you may need to seek help.

File formats play a part when it comes to video editing. Video editors allow you to cut parts out of your clips or put them together with titles and sound tracks. The latest Windows computers come with a free video editor called *Windows Movie Maker*. This is a little limited when compared with packages such as *Pinnacle Studio* or *Ulead VideoStudio* (video editors used in a number of schools) but it is an excellent starting point and is easy to use.

1. www.sserc.org.uk/members/SafetyNet/bulls/221/ICT.htm
2. www.formula1.com/

Digital Video Cameras - a comparison

We looked at two cameras that could be used to take video clips for use in the classroom.

Sanyo Xacti C4 - This costs around £130 including VAT and purchasers would be wise to add a SD card of at least 512MB. Such a card would give around 20 minutes of filming at the Sanyo's maximum quality setting. At this setting, it takes video pictures at a rate of 30 frames per second and a resolution of 640 x 480 pixels. This is slightly below DVD quality but is at least as good as an old-style analogue camcorder. Motion is smooth, colours are natural and detail is good. There is little sign of blockiness. The Sanyo has an autofocus facility and both optical and digital zooms. It creates *.MP4* files. These can be played on computers with version 6.5.2 of *Quicktime* or above installed. At the time of writing, a number of the computers we tested this camera with did not play the files as they did not have this version of Quicktime installed. Fortunately, it is easy to convert *.MP4* files to a format that Windows Media Player and most video editors will recognise, though the immediacy of being able to take a video clip in the classroom and play it straight away is lost. This is unlikely to be an issue for much longer as more computers are updated to the latest version of Quicktime. *Windows Movie Maker* could not edit Sanyo files but *Ulead VideoStudio 10 Plus* could. Like Movie Maker, some other editors would require file conversion. A free converter is available at http://mp4cam2avi.sourceforge.net

When we investigated using *Logger Pro* software from Vernier to analyse motion captured on video, we found that it could import the Sanyo's video clips without conversion.

The Sanyo can also play clips to TV and produces very good still pictures. It has a built-in replaceable rechargeable battery and can connect to a computer via the charging cradle or a USB lead.

Mustek DV5000 - This has now been replaced by the similarly-priced DV8200. The camera costs around £60, inclusive of VAT. One retailer was giving away a 256Mb SD card at this price, a useful addition that would allow around one hour of video. The DV8200 has a higher resolution image sensor than the DV5000 but the video resolution is the same in each case at 640 x 480 pixels. At this resolution, a frame rate of 10 frames per second is possible. If faster frame rates are to be used, resolution drops. Although nominally the maximum resolution is the same as that of the Sanyo, picture quality does not seem as good. Colours are slightly flat and some edges in images have a serrated appearance. That said, quality still approaches that of older, non-digital tape camcorders. The Mustek's lens has only two focus settings, normal and close-up. It has a digital zoom, meaning that zooming in on objects reduces the picture quality. The Mustek creates MPEG 4 files with the file extension *.ASF*. File transfer is by USB. Files were playable in most of the computers we tried. Machines that initially did not play them subsequently did so when a package called *DIVx* was installed. Again, this is free and can be found at www.divx.com.

Windows Movie Maker 2 was able to take the Mustek's files and edit them without conversion, as was *Ulead VideoStudio 10 Plus*. Other video editors required conversion. A free converter is available from www.stoik.com

The Mustek can play clips directly to TV. It can also function as a still camera, voice recorder and MP3 player. Stills quality was well below that of the Sanyo to the point where we could not rely on the Mustek for acceptable stills in any but the best of lighting conditions. Unlike the Sanyo, the Mustek takes conventional AA batteries. Whilst we would recommend using NiMh rechargeables, the wide availability of AA batteries in shops makes it unlikely that the user would ever be stuck with an unusable camera.

Mustek DV5300SE (Quick Review)
Just before going to press we bought a Mustek DV5300SE camera. This is similar in specification to the DV5000 but is far more capable at taking stills. It lacks the DV5000's close up mode but can handle time interval recording (short bursts of video at regular intervals) and can be set to record when motion is detected.

Those at SSERC who have used it have found it to be excellent value for money. We got ours from *CPC* (www.cpc.co.uk), part number CS13015.

A company called *3wisemonkeys* is doing them for around £60 c/w a 512 Mb SD card - http://www.3wisemonkeys.co.uk/products.jsp?cat=14

Sanyo Xacti	
For	**Against**
Fast frame rate Good quality video & still pictures Optical zoom	A number of computers cannot play or edit files without suitable (free) software upgrades. (This is unlikely to be an issue for much longer)

Mustek DV5000 & DV53000SE	
For	**Against**
Inexpensive Files playable instantly on a wide variety of machines Takes standard AA batteries - reasonable life with high capacity NiMh batteries Light & compact	Still pictures rather poor (much better with the newer 5300SE) LCD screen hard to see in bright light Lower resolution required if fast frame rate is used. No optical zoom